

Calibration Status of the Atmospheric Infrared Sounder (AIRS) on Aqua

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AGENDA AIRS Calibration Status

- Instrument Status
- Algorithm Status
- Level-1B Data Usage



Instrument Status AIRS Calibration Status

- Instrument continues to exceed requirements and expectations
- Radiometric accuracy excellent, unchanged
- Radiometric stability excellent, as shown by Aumann
- Spectral stability excellent, variability now modeled by Strow
- Spatial performance described below
- Recent scan mirror stoppage had no effect beyond the data dropout (19+ hours)



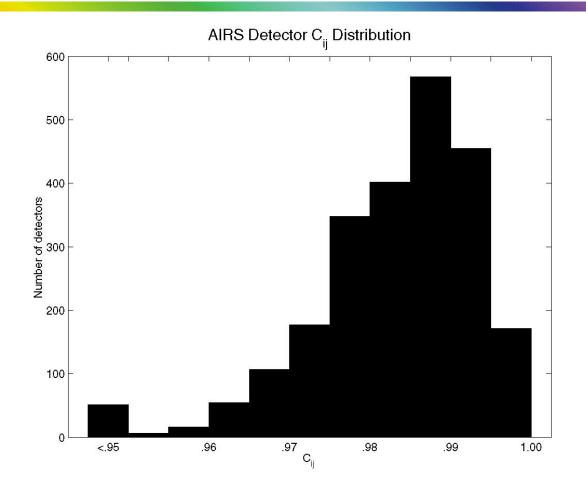
Spatial Performance AIRS Calibration Status

- Spatial performance falls in two categories: geolocation and coalignment
- Geolocation has been validated to better than 2.5 km (1/5 IFOV) at nadir based on analysis of coastline crossings with AIRS IR and AIRS VIS/NIR (Gregorich)
- Coalignment is good and well characterized in wellpublicized sources (the Channel Properties File)
- Details of measured IFOVs as well as calculated smeared FOVs as a function of scan angle will be made available through the AIRS website.



Cij Distribution AIRS Calibration Status

- Coregistration shown for all 2378 channels
- Median = 0.985





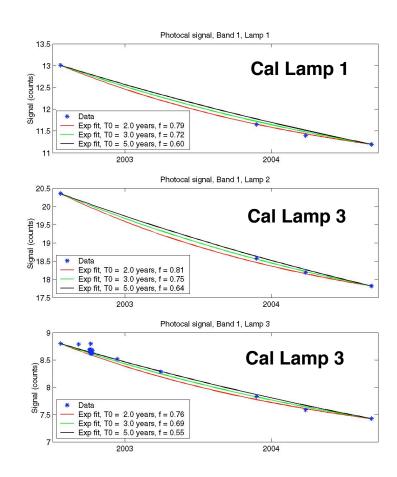
Algorithm Status AIRS Calibration Status

- · Stable overall, except VIS Band 1
- Many small changes (listed below)
- Small impact



VIS Band 1 AIRS Calibration Status

- Decrease in responsivity observed
- Attributed to scan mirror coating change
- Corrected for, assuming exponential decay, 3-year time constant
- 28% total decay predicted for band 1 at T=infinity
- 0.8% total decay predicted for band 2 at T=infinity





Algorithm Changes for v4.0 AIRS Calibration Status

| Change | Description | Radiance impact? | QA Flag impact? |
|---------|------------------------|------------------|-----------------|
| CR-808 | New channel properties | No | Yes |
| CR-760 | Offset smoothing | Yes | Yes |
| CR-769 | Radiance Rounding | Yes | No |
| CR-??? | Rdiff modifications | No | Yes |
| CR-797 | Cold scene noise | No | Yes |
| NR-694 | VIS trend | Yes | No |
| AR-1768 | Bad gain bit | No | Yes |
| CR-778 | Focal Map Update | No | No |
| CR-764 | Gain filtering | Yes | No |
| CR-822 | Overflow warning | No | No |



Channel Property File Changes AIRS Calibration Status

- Revised frequencies for M5
- Better noise estimates (decreased for M11, M12, increased slightly for other modules)
- Revised spatial centroid data
- Corrected C_{ii} values (old values were junk)

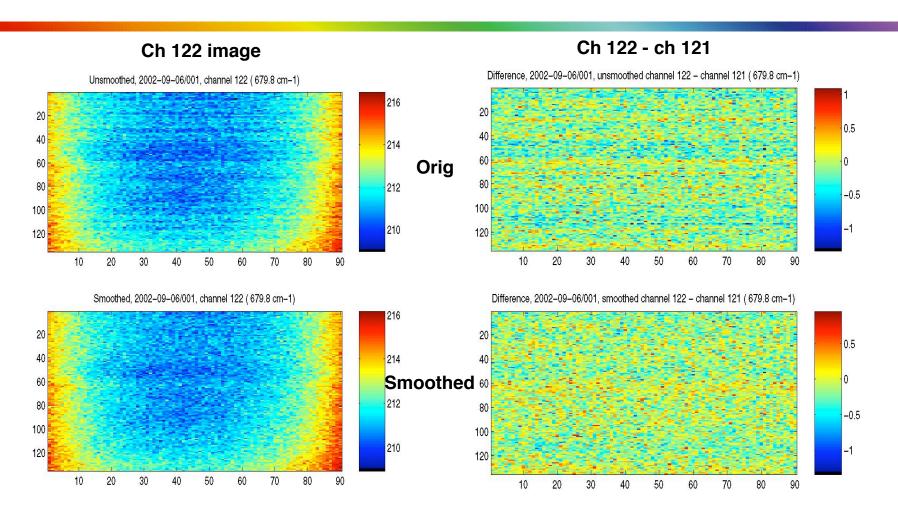


Offset Smoothing AIRS Calibration Status

- Implemented to reduce "striping" (artificial correlations within a scanline)
- Previous algorithm calculated offset for each channel once per scan as the median of 8 space views
- New algorithm calculates offset by linear fit in time across
 10 scan lines
- Changes (corrects) scan angle-dependent biases by up to 10 mK in some channels
- Slightly improves noise estimates

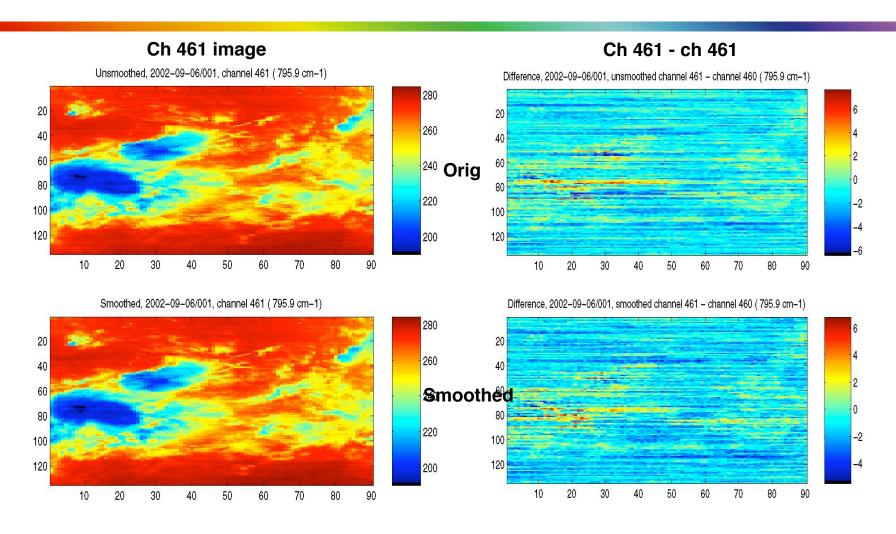


Offset smoothing example AIRS Calibration Status





Offset smoothing example AIRS Calibration Status





Algorithm changes, retrieval impact AIRS Calibration Status

- V3.7.12 retrieval
- V3.7.12 and v3.7.3 radiances
- Changes include radiance rounding and offset smoothing
- For this granule, for RetQAFlag = 0:

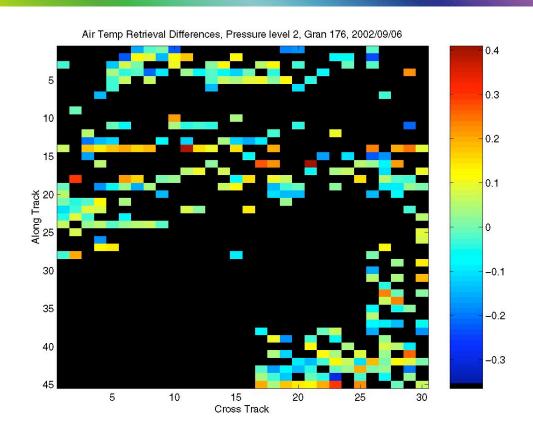
Mean = 0.0046K

Std = 0.17K

Max = 0.97K

Min = -0.77K

 Hearty performed a more detailed analysis, found no impact





AIRS Data Usage AIRS Calibration Status

- Using data quality indicators is the users' responsibility
- Providing those quality indicators is the AIRS team responsibility
- Quality indicators are provided statically in the form of channel properties files, and dynamically with data present in the standard Level-1B products.
- The channel properties file contains a static estimate of the channels' characteristics, including properties which were only measured pre-launch (boresight, SRF)
- The L1B radiance products contain on-the-fly estimates of noise, as well as indicators of abnormal behavior by the instrument or algorithms



AIRS L1B Data Quality Sources AIRS Calibration Status

Channel Properties File

Frequency centroids, widths
NEdTs (static)
Spatial centroids
"AB_States"

L1B Data Product

CalFlag, CalChanSummary,
CalScanSummary,
CalGranSummary
NeNs (dynamic)
SceneInhomogeneous flag
Rdiff indicators

Radiances



AIRS L1B QA Filtering Prescription AIRS Calibration Status

Consider a candidate channel measurement.

Evaluate it radiometrically:

- If AB_State > 2, the channel has known radiometric problems, so don't use it.
- Pick a noise limit. Filter on it based on the Channel Properties File (OK) or on dynamic NeN estimates (better).
- Look at CalChanSummary: If any of these bits are set
 - 6: Anomaly in offset calculation
 - 5: Anomaly in gain calculation
 - 4: Pop detected
 - 3: High noise

then don't use that channel for that granule.



AIRS L1B QA Filtering Prescription (cont.) AIRS Calibration Status

Evaluate it spatially:

If you are sensitive to channel co-registration, you must either

1) Use C_{ij} and/or boresight centroids to limit yourself to coaligned channels (and only you can determine what your requirement is),

OR

2) Use the SceneInhomogenous flag, the Rdiff values, and/or the radiances themselves to restrict yourself to uniform scenes, where coregistration isn't a concern. Again, only you know how sensitive you are.



AIRS L1B QA Filtering Prescription (cont.) AIRS Calibration Status

Evaluate it spectrally:

You are sensitive to the shape of the spectral response function if you are using the AIRS RTA or if you are brewing your own radiative transfer algorithm. If so, avoid using channels with the "SRF shape" comment in the Channel Properties File.



SUMMARY AIRS Calibration Status

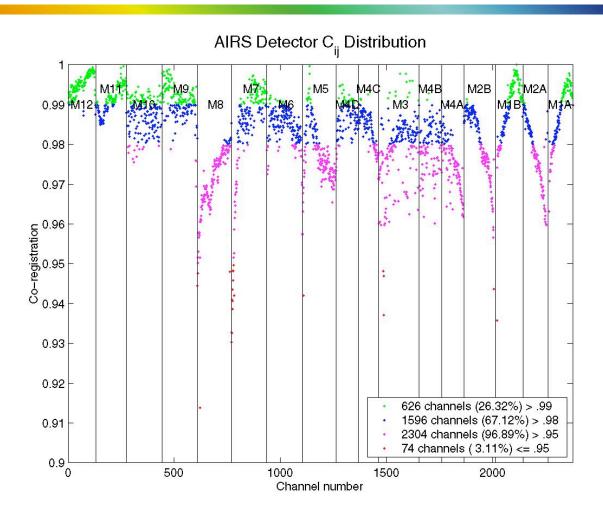
- The AIRS instrument continues to function excellently.
- The AIRS L1B algorithms and QA indicators are working well, and have been subject to only minor changes.
- Data users must filter data based on their own needs, using static and dynamic radiometric, spectral, and spatial QA indicators.



Backup Slides AIRS Calibration Status



Cij Distribution AIRS Calibration Status





Centroid Distribution AIRS Calibration Status

